

Upper Mississippi River Nine-Foot Channel Project,

Lock and Dam Complex Number 22

Spanning the Mississippi River between

Saverton

Rolls County

Missouri

and

(Pike County

Illinois)

HAER No. MO-35

HAER

MO,

87-SAV,

1-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
Rocky Mountain Regional Office
National Park Service
U. S. Department of the Interior
P. O. Box 25287
Denver, Colorado 80225

HISTORIC AMERICAN ENGINEERING RECORD

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Location: Spanning the Mississippi River just downstream from Saverton, Missouri, and 343.2 river miles upstream from the confluence of the Ohio and Mississippi rivers. The complex stretches across the river at a point where, although the bluffs rise over 200 feet from river level west of the lock, the valley is quite wide to the east. From the lock, the bluffs to the east are about 5 miles away. The esplanade adjoins the steeply rising bluff on the Missouri shore, the lock is just riverward of the esplanade with the movable section of the dam tying to the westernmost lock wall. The earthen embankment section of the dam extends from the movable section to the levee, protecting the wide flood plain on the Illinois shore. Corps drawings numbers M-L 22 10/1; 10/2, 10/2, 10/9; HAER photograph numbers MO-35-1 through MO-35-21.

Dates of Construction: 1932-1935

Present Owner: U. S. Government
Rock Island District
Corps of Engineers

Present Use: River navigation/hydrology control

Significance: The U. S. Army Corps of Engineers Nine-Foot Channel Project (1927-1940) represents the culmination of a 100-year effort to improve the navigability of the Upper Mississippi River between the mouth of the Missouri River and Minneapolis, Minnesota. This specific project arose as a response to the farm crisis of the 1920s. Proponents of the New Deal adopted the project and gave speed to its construction as a means of providing public employment during the more general depression of the 1930s. By the 1940s, the completed project had converted over 650 miles of free-flowing river into a series of interconnected reservoirs which ensured enough water for fully loaded modern boats and barges to navigate the system. This constituted a significant alteration of the natural environment of the Upper Mississippi River. However, the project also brought economic benefits to the communities along and around the river corridor and lead to new recreational opportunities for the entire region.

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The Upper Mississippi River Nine-Foot Channel Project inaugurated a new development in slack-water navigation system dam practice in the United States: the adoption of a non-navigable dam containing both roller and Tainter gates. Prior to the Corps' 1930 decision to build non-navigable dams on the Upper Mississippi River, United States Army engineering practice had, nearly universally, been to construct navigable dams, permitting open-river navigation at higher river stages. By 1930, European engineers had been using roller gates in dams extensively for over 25 years. However, only ten such structures had been built in the United States, and these were all located on reaches of rivers where ensuring navigability of any sort was not a design concern. It was not until 1925-1926 that civilian engineers pioneered the use, in the United States, of roller gates in combination with other types of gates. Most of the Corps' Upper Mississippi River project dam designs expanded upon this development, incorporating both roller and Tainter gates. The Corps' shift from navigable to non-navigable dams demonstrate the influence of shipping techniques on navigable waterway improvement technology. It also exemplifies the cautious nature of American Army engineers response to changes in shipping. The Corps' choice of this particular type of non-navigable movable dam illustrates the influence of the hydraulic characteristics of individual rivers on the selection of waterway improvement technologies. It also evidences the manner in which critical engineering design developments are disseminated and become accepted.

Ironically, the Upper Mississippi River Nine-Foot Channel Project also resulted in the obsolescence, by the project's end, of combination roller and Tainter gate dams. Technological advances resulting from the research and development incidental to the design and construction of the 26 lock and dam systems in this project enabled U. S. Army Corps of Engineers to develop both submersible and non-submersible Tainter gates which nearly matched the capabilities of the roller gates. Once these less expensive and easier operated and maintained gates had been developed, American engineers ceased designing or constructing combination roller and Tainter gate dams. The Corps'

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creation of a new dam type and its subsequent
obsolescence during the course of a single project
dramatically illustrates both the evolutionary nature
of American engineering in general and the Nine-Foot
Channel Project in particular (Text, pages 11 and
49-50. See HAER No. IA-23 for complete history,
footnotes and bibliography).

Historian:

Mary Yeater Rathbun

August 1988

PART I. HISTORICAL INFORMATION

A. Physical History:

1. Dates of Erection: 1934-1939
2. Architect/Engineer: U. S. Corps of Engineers, Rock Island District
3. Original and Subsequent Owners: U. S. Government--Rock Island District, Army Corps of Engineers
4. Builders, Contractors, Suppliers:

General Contractor--Lock and Central Control Station Construction:
Joseph Meltzer, Inc., New York, New York

Subcontractors:

Beckman Painting Corp.Painting all exposed metal parts
Chicago, Illinois
Carty Motor Company.....Hauled excavated material
Canton, Missouri
C. T. Welsh CompanyFilled and removed fill from
Minneapolis, Minnesota.....cofferdam and placed esplanade fill
Drake Marble Company.....Tile floor in Central Control
St. Paul, Minnesota Station
Elff Plastering Company.....Interior plastering of Central
Quincy, Illinois Control Station
Middendorf's Inc.Roofing Central Control Station
Quincy, Illinois
Reen & Dahl.....Hauled excavated material
Stoughton, Wisconsin
Quincy Decorating Company.....Painted interior Central Control
Quincy, Illinois.....Station
Ward Plumbing and Heating Company Plumbing and heating Central
Quincy, Illinois Control Station
Independent Bridge CompanyFurnished fabricated metal work for
Pittsburgh, Pennsylvania.....lock

General Contractor--Dam Construction: S. A. Healy Company, Detroit,
Michigan and Davenport, Iowa

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Subcontractors:

Sammons-Robertson-Henry Co.Drill test holes; rock excavation;
Huntington, West Virginia rock channeling; common
 excavation; removal closing dam
H. E. Pederson.....Placing reinforcing steel
Simon Kselssas Painting Co.Paint tainter and roller gates,
 emergency bulkheads, service
 bridge, seals, stop logs, roller
 gate machinery, steel diaphragms 9;
Wapelloo Construction Co.Wing dam removal; raise Illinois
 levee; excavation for derrick
 stone; cofferdam fill; dike and
 storage yard fill
Hunter Steel Company.....Tainter and roller gates, service
Pittsburgh, Pennsylvania bridge; roller and tainter gate
 operating machinery; service
 bridge rail; trunions; handrails,
 bulkheads, yarding material
Federal Engineering and.....Built electric transmission line
Construction Company from Hannibal, Missouri, to site
Kansas City, Missouri

General Contractor--Power, Control, and Lighting System: E. A.
Koeneman Electric Company, St. Louis, Missouri

Subcontractor: American Hoist and Derrick.....Haulage units

General Contractor--Improvement of Esplanade: McCarthy Improvement
Company, Davenport, Iowa

Subcontractor: Cyclone Fence Company, Waukegan, Illinois.....Lockwall
fence and fencing

General Contractor--Access Road: Edgar D. Otto, Inc., Downers Grove,
Illinois

Subcontractor: O'Meara Construction Company, Quincy, Illinois.....
all roadway excavation and fill

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5. Original Plans and Construction:

U. S. Army Corps of Engineers, Rock Island District, plans for lock submitted by associate engineer E. E. Abbott. By the time he submitted the plans for the dam, he had been promoted to senior engineer.

6. Alterations and Additions:

<u>Item</u>	<u>Year</u>
Construction-500-foot call foundation concrete extension to upstream end of river wall of lock	1940-1943
Construction-upper approach flow deflecting sand dike	1941-1942
Construction-500-foot earthen upper guidewall extension and mooring piers	1942
Land wall and lock gate handrails lowered by one rail and new handrail made from salvaged materials installed on both edges of each lock wall and on upstream side of walkways on top of lock gates	ca. 1945
Construction-handrail on upstream side of dam service bridge	ca. 1945
Construction-further extension of upper approach dike	1950
Construction-additional mooring facilities	1951
Construction-frame air-lock vestibule at upstream end door of central control station	ca. 1970
Addition-boat launches on lock walls	ca. 1970
Replacement - haulage units	ca. 1971 and 1973
Construction-metal and glass shelters around land wall control cabinets and at ends of the guidewalls of lock	ca. 1972
Removal-Lockmaster/Assistant Lockmaster residences from esplanade	ca. 1975
Removal-standby generator from machinery room of central control station	ca. 1975

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Construction-metal and glass shelters around land wall control cabinets and at end of the guidewall of lock	ca. 1972
Removal-Lockmaster/Assistant Lockmaster residences from esplanade	ca. 1975
Removal-standby generator for machinery room of central control station	ca. 1975
Construction-emergency generator building	ca. 1975
Replacement--wooden plank hatches on dam service bridge with aluminum ones	ca. 1979
Installation-traveling mooring kevels extending length of guidewalls of lock	1980
Construction-new workshop building	1980-1981
Replacement-crane on dam	1983-1984
Replacement-light posts and light fixtures around lock	1984

B. Historical Context:

The special board of engineers which initially designed the Nine-Foot Channel Project between 1927 and 1931 did not see the construction of Lock and Dam Complex 22 as a high priority and placed it in the fourth group of projects to be constructed.

Most significant items of engineering significance at complex 22 relate to the dam. It was on the submergible roller gates at Dam 22 that the Rock Island District first incorporated Poiree Dam trestles to mitigate the scour problem. The device was subsequently used as a retrofit solution to scour problems at the Rock Island District dams already constructed. It was also these Dam 22 submergible rollers that the St. Paul District Hydraulic Laboratory conducted the tests that led to the design of still-in-basins for the roller gate sections of the dams. The Rock Island District also incorporated an experimental design for the submergible roller with end shields at Dam 22. But, even more significantly, the district introduced new non-submergible truss-type Tainter gates at Dam 22.

Complex 22 consists of a dam system composed of nine 1a-type Tainter gates, one 1b-type Tainter gate, three submersible roller gates, two transition

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dikes, and a submersible earth and sand-filled dike. Lock dimensions are the standard 110 feet by 600 feet, with additional footings for an auxiliary lock of standard dimensions. Lock lift is 10.5 feet. Normal upper pool elevations is 459.5; this is about 16.5 feet above the tail waters of the dam at low water. When both pools are at their normal depths, the difference in elevation is reduced to 10.5 feet or less.

The lock and dam elements of the complex took a little over four years to complete (or just about a year longer than average) at a cost of \$5,135,000. During the peak of construction, 959 people were employed in the construction of the complex. The complex was placed in operation as a unit of the Upper Mississippi River navigation system on July 22, 1938. It was the sixth of the 1931-1940 Upper Mississippi River Nine-Foot Channel Project complexes in the Rock Island District to go on line.

PART II. TECHNOLOGICAL INFORMATION - LOCK

A. General Statement:

1. Design Character: Standardized Ohio-Mississippi Lock Design. Drawing Number M-L 20 20/1.
2. Condition of Fabric: Concrete cracked extensively; condition of metal parts is good.

B. Description of General Layout and Principal Elements:

1. Overall dimensions: Main lock chamber - 110 feet wide by 600 feet long by 40 feet high; adjoining incomplete auxiliary lock chamber 110 feet wide by 40 feet high. Lift - 10.5 feet. Drawing Number M-L 20 20/1.
2. Foundations: Bedrock.
3. Walls: Reinforced monolithic concrete with steel rub bars on their chamberward faces upstream and downstream from the lock gates. Land wall adjoins Missouri shore. Intermediate wall is riverward wall of main lock and landward wall of incomplete auxiliary lock. River wall of auxiliary lock ties to dam on east. Drawing numbers M-L 22 20/4, 20/6, 20/9, 20/15, 20/19, 20/20, 20/28.
4. Structural System: See above.
5. Bullnoses: Concrete configurations at each end of intermediate wall. Drawing number M-L 22 20/19.

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6. Upper and Lower Guidewalls: Extended monolithic reinforced concrete walls extending the landwall out of the lock chamber at either end to assist guiding of barge traffic into the lock. Drawing number M-L 22 20/11.
7. Riverwall Extension: Extension to upstream end of riverwall. Added 1943. To assist in counteracting outdraft which made navigation into and out of the upstream end of the lock difficult.
8. Guidewall Extension: Transition wall of sheet piling on upstream end of landwall ties to 500-foot long earthen mooring dike. Also intended to assist in counteracting outdraft which made navigation into and out of the upper end of the lock difficult.
9. Stage Recorder: Small concrete housing located at the end of the downstream guidewall. Equipment housed for the recording of river stages.

C. Mechanical Equipment:

1. Tainter Valves: Four cable drive lock valves of steel construction with electric motorized assembly. Valves are located in wells in lock walls. They are operated by switches in weather-proof control cabinets on lock walls, with a cabinet beside each gate recess. Control cabinets on landwall surrounded by metal and glass shelters since mid-1970s. Drawing numbers M-L 22 25/1; 28/1, 20/12.
2. Gates: Two pairs of miter gates on main lock and one pair on upstream end of incomplete auxiliary lock. All three pairs are balanced on stainless steel pintels. Those in main lock are operated by arms, gears, and electric motor assemblies. The gates are operated by switches in control cabinets. Bumper lines of chamber face of gates also of stainless steel. All other associated metal parts are of steel, stainless steel, or steel/nickel alloy. Drawing numbers M-L 22 21/1; 21/17; 22/1.
3. Lighting: Various freestanding single and double head lighting standards, installed in 1984.
4. Plumbing: Lock is watered by the Tainter valves (see above) serving a system of cast-in-place tunnels that enable the water level to be controlled on the interior of the lock.
5. Haulage Unit: Motorized winch assembly to assist towing of barges through lockage. Replacement units were installed in the mid-1970s.

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6. Traveling Mooring Kevels: Two large cleats on rails which extends the length of both the upstream and downstream guidewalls. Installed in 1980, the kevels are used to assist towing of barges through lockage.

D. Other Elements:

1. Auxiliary Lock: Fixed miter gate without machinery and partial walls are located riverward of the main lock. It is equipped with wells for machinery placement, but was never completed or put into service. Drawing Numbers M-L 20 20/1; 20/3.
2. Lineman Guide Cell: Concrete cell foundation structure downstream from lock on line with intermediate guidewall.
3. Mooring Cell: Concrete cell foundation structure upstream from landwall. To assist in counteracting outdraft.
4. Boat Launches: Built ca. 1970, the launches are single-armed derricks of metal construction.

PART III. TECHNOLOGICAL INFORMATION--MOVABLE SECTION OF DAM

A. General Statement:

1. Design Character: Combination roller/tainter low dam system design. Drawing Number M-L 22 40/1.
2. Architectural Character: 2b roller gate piers. Drawing Number M-L 22 40/2
3. Condition of Fabric: Concrete-extensively cracked; metal parts in good condition.

B. Description of Exterior

1. Overall Dimensions: 1,224 feet in length. Drawing Number M-L 22 40/1.
2. Foundation: Bedrock
3. Pier House Walls: Monolithic reinforced concrete. Drawing Numbers M-L 22 41/1 and 41/2.
4. Structural System: Monolithic concrete/structural steel.
5. Fenders: Concrete fenders located at the base of each pier.

6. Openings:

- a. In Overall Structures: 13 water-channels and 2 archways; clustered in groups by sizes, west to east--3 water-channels ca. 40 feet wide; 3 water-channels ca. 100 feet wide; 6 water-channels ca. 60 feet wide; 2 archways ca. 60 feet wide. Drawing Number M-L 22 40/1.
- b. In Pier Houses: 1 doorway, 1 floor hatch, and 11 three-pane windows for each of four pier houses. Drawing Number M-L 22 40/1.
 - (1) Doorways and doors: 4
 - (2) Windows: 44
- c. In steel diaphragm section of roller gate piers: 1 doorway and door in each of the four steel diaphragm sections. Four doorways and doors. Drawing Number M-L 22 40/2.
- d. In Access Tower: 2 doorways and doors. Drawing Number M-L 22 40/4.

7. Roofs:

- a. Shape, covering: Pier houses have flat roofs covered in membrane/tar composition. Drawing Number M-L 22 41/3.
- b. Towers, abutments, piers: 2 abutments; lockwall abutments includes access tower; 14 piers (8 tainter gate piers, 2 2b-style roller gate piers, 2 2b-style transition piers or combination tainter and roller gate piers, and 2 service bridge extension piers); 4 2b-style piers have pier house towers. Drawing Numbers M-L 22 40/1; 40/4; 40/17A; 40/3; 40/2; 40/10; 40/11; 40/13; 40/25.

8. Service Bridge:

- a. Shape: Arched spans in a segmental series.
- b. Materials: Structural steel. Drawing Number M-L 22 53/1.

C. Description of General Layout and Principal Elements:

- 1. Access Plan: Simple stairway in the access tower which itself is part of the abutment resting on the riverwall of the auxiliary lock. This

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stairway leads to service bridge deck where walkway/rail tracks extend full length of dam. Access to all four pier houses directly off deck. Access to storage yard below easternmost 200 feet of dam by simple exposed stairway at the western end of service bridge. Drawing Numbers M-L 22 40/1; 40/4; 40/7; 53/1; 53/9; 53/10.

2. Stairways: In access tower--reinforced concrete with pipe railing; at end of service bridge extension--open metal with pipe railing. Drawing Numbers M-L 22 40/4; 53/1.
3. Flooring: In pier houses and access tower--reinforced concrete; on service bridge deck--wooden plank. Drawing Numbers M-L 22 40/4; 40/7; 53/10.
4. Wall and Ceiling Finish: Reinforced concrete. Drawing Numbers M-L 22 40/4; 40/5.
5. Hardware: Brass.

D. Mechanical Equipment:

1. Movable Gates: Nine 60-foot-wide by 25 feet high, 2a-type Tainter gates operated by line shafts and motors housed in installations above each gate; three 100-foot-wide by 25 feet high, submersible roller gates operated on tooth track by chain driven hoist machinery located in pier house adjacent to each gate; one 60-foot by 25 feet high, 2b-type Tainter gate operated by line shafts and a motor housed in an installation above the gate. Drawing Numbers M-L 22 48/1; 47/1; 55/1; 54/2.
2. Movable Crane: 30-ton vertical lift electric crane with 70-foot boom (replaced in ca. 1980 used for moving parts and equipment. Sits on original (ca. 1938) crane trolley which also supports additional bridge crane used for lifting emergency bulkheads, etc. Trolley rides on 15-gauge track system running entire length of service bridge deck. Drawing Numbers M-L 22 53/11; 53/13; 58/6.
3. Lighting: Fixtures as of time of installation 1937-1939 -- Rewiring may have taken place over the years. Extent is unknown. Drawing Number M-L 22 56/1.

E. Other Elements:

1. Earth Dikes: Three dikes in segmental series--130-foot-long earth and sand-filled transition dike extends from eastern end of storage yard to 1600-foot-long earth and sand-filled submersible dike,

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followed by another 130-foot-long transition dike to levee along Missouri shore. Drawing Numbers M-L 22 40/1, 52/1, 52/2.

Emergency Bulkheads: Temporary block units of riveted structural steel girder construction placed in gate openings in periods of emergency or repair. Drawing Numbers M-L 20 58/1, 58/4.

2. Emergency Bulkhead Car/Tracks: Located in storage yard, the flat cars designed to store and access bulkheads. Drawing Numbers M-L 22 53/13, 40/27.
3. Storage Yard: 200-foot-long area extending from east abutment under service bridge extension, i.e., under last two archways in dam. The yard contains replacement parts for gates, bulkheads on track cars and related items. Drawing Number M-L 22 40/27.

PART IV: TECHNOLOGICAL INFORMATION-ESPLANADE AREA

A. Description of Esplanade--General Layout:

1. Design Character: Standardized park/service area and access road component. The main esplanade area was originally designed to accommodate the Central Control Station, Lockmaster and Assistant Lockmaster Residences, parking, an access road, and other service-related functions. Major site alterations have occurred since that time and are noted in the following items.
2. Architectural Character: 1b Central Control Station. Drawing Number M-L 22 70/1.
3. Historic Landscape Design: Based on standardized designs--see drawings for Lockmaster's residences.

B. Condition of Site and Structures: Altered

1. Central Control Station - Exterior: Standardized 1b construction. Drawing Number M-L 22 70/1.
 - a. First Floor: Contains machinery room where central control panel is located, bathroom, main office, and basement stairway access. Standby generator which dominated machinery room removed in mid-1970s. Central control panel removed from machinery room between 1986 and 1988 as par of major rewiring of complex which was part of major rehabilitation of complex. Drawing Number M-L 20 70/2.

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- b. Basement: Contains storage and equipment rooms. All interior finishes altered from original construction. Drawing Number M-L 22 70/2.
2. Lockmaster's/Assistant Lockmaster's Residences (standardized, Colonial Revival with side porch): The structures has been moved off site. Related structures, such as garages, have been demolished.
3. Outbuildings: Various shed and service buildings have been erected from time to time as demands required--none have particular significance or contribute to the site. A metal emergency generator building was constructed just upstream from the Central Control Station in the mid-1970s. It is a standardized element. A new garage structure of brick and steel was erected on the old site of the Lock Master's residence ca. 1980. This element is also standardized.

PART V: SOURCES OF INFORMATION

- A. Original Architectural/Engineering Drawings: Mississippi River Lock and Dam 22, lock operations folio, February 1936, file No. GP68-2; Missisaippi River, Lock and Dam 22, dam operations folio, April 1940, file No. GP68-2; Rock Island District Office-Construction Drawings--Mississippi River Locks and Dams 1940-1986, (passim), Rock Island Diatrict Library, Clock Tower Building Annex, Rock Island, Illinois.
- B. Early Views: Over 1,000 high quality 8x10 black and white construction photographs: Lock and Dam Number 22-Photo Book groups 2215, 121.1514 (3 vola.), 2245, Rock Island Arsenal, Rock Ialand, Illinois.
- C. Interviews: Present and past peraonnel--Lock and Dam Number 22.
- D. Bibliography:
 1. Primary and unpublished sources: National Archives Record Group 77, Entry 81, Chicago National Archives and Recorda Center; National Archives Record Group 77, Entries 111 and 112, Washington National Records Center, Suitland, Maryland; Chief of Engineers Annual Reports, 1927-1987; see also bibliography in HAER No. IA-23 narrative history.
 2. Secondary and published sources: See bibliography in HAER No. IA-23 narrative history.
- E. Likely Sources Not Yet Investigated: National Archives Record Group 77, Entry 107 (132 linear feet), Washington National Records Center, Suitland, Maryland; National Archives Record Group 77, Entry 1656, exact repository

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unknown; and National Archives Record Group 77, Entries 608, 609, and 610 (collective total 5 linear feet), National Archives, Washington, DC.

- F. Supplemental Material: 83 film canisters of 1931-1939 silent movies of the construction process taken by the Corps of Engineers, Rock Island District Office, Rock Island Arsenal, Rock Island, Illinois.
- G. Notes: The notes for this routine are contained in the notes section of HAER No. IA-23 narrative history.